be traced. Food or water exposed to the danger of sewage or fæcal contamination, as for instance Thames water, containing a certain percentage of *B. coli commune*, cannot be said to be freed from all pollution. Further we cannot go.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

THE Head Masters' Conference at Rugby last week passed the following resolution unanimously:—"That the Conference deplores the time wasted in teaching boys the present system of weights and measures, and would welcome the introduction of a more rational system."

AMONG the French Universities which, in accordance with the new Act, will at the end of next year be permitted to dispose of the money accruing from students' fees, &c., the richest will be that of Lyons, which will thus have an annual income of over 5000*l*. According to the Paris correspondent of the *Chemist and Druggist*, schemes are already on foot for important educational extension in the capital of the centre. The Lyons Faculty of Medicine and Pharmacy, as well as the Faculty of Sciences, will probably be enlarged, and new laboratories built or the present ones extended. But the most important project is the construction of a Chemical Institute, in which will be reunited the various chemistry services of the two above-named faculties; and the already flourishing School of Commercial and Agricultural Chemistry will be also installed in this new building. The erection of this Institute will, it is hoped, be commenced next spring, and the cost is calculated at 60,000*l*., but the municipality will give the site, valued at 16,000*l*., and possibly other aid. The department has voted 2000*l*., and the State, it is hoped, will contribute over 25,000*l*. The head of the University states that, while laboratory research will not be neglected, the University will seek "to incorporate itself more and more with the industrial city" and "develop the technical instruction that may serve the commercial and manufacturing interests of a great city of half a million souls."

SCIENTIFIC SERIALS.

Wiedemann's Annalen der Physik und Chemie, No. 12.—Directed electric surface conductivity, E. Braun. Continuous transition of electric properties in the separating surface of solid and liquid bodies.—Conduction of electrified air. Magnetic currents. By the same author. Crystals have a different electric conductivity in different directions. This was proved by Wiedemann by dusting lycopodium powder on a cleavage surface and sending a spark from a wire into it. An elliptic area was cleared, with axes in a ratio varying from 1 : 2 to 1 : 3. The author obtained different surface conductivities with a steady current, through a layer of condensed moisture. The effect vanished when the thickness of the layer exceeded 50 $\mu\mu$. A steady transition from the polarisation properties of a solid to those of a fluid body may be traced in the surface layer.—Polarisation phenomena in vacuum tubes, by C. A. Mebius. When the current through a gas increases, the rate of fall of potential at the kathode increases more rapidly than at the anode. When secondary terminals are introduced, so as to give a transverse current, the rate of fall of potential at these decreases with an increase of the main current, when a current of a certain strength is sent through the secondary terminals.—On the transition of carbon from the non-conducting to the conducting condition, by G. Brion. The conductivity of carbon depends upon the highest temperature to which it is exposed, the time since elapsed, and the present temperature. It is acquired very rapidly at temperatures between 800° and 1000° C. The conductivity decreases rapidly during the first few hours after heating, and then more slowly.—On electro-capillary light, by O. Schott. On sending the sparks from an induction coil through a capillary tube 0·05 mm. in diameter containing air at ordinary pressure, an intense light is observed in the tube. The latter soon gets roughened and blown out into spherical bulbs. Wider tubes gave a less intense light, and are less altered. Electrodes of various metals may be used with the same effect. In the spectroscope, the light shows a continuous spectrum crossed by bright lines, and dark lines along the spectrum which shift their position at every discharge.—Glow-worm light, by H. Muraoka. Natural glow-worm light behaves like ordinary light. But when it is filtered through cardboard or through copper plates, it shows the properties of X-rays or Becquerel's fluorescence rays. The intensity of the action of the glow-worm rays is intensified by the presence of the cardboard near the sensitive plate. They may be reflected, and probably also refracted and polarised. The author operated with 300 glow-worms at Kyoto, Japan, during the month of June, when thousands of them swarm about the neighbourhood.—An attempt to demonstrate the existence of electrodynamic solar radiation, by J. Wilsing and J. Scheiner. Owing to the absorption of the longer waves by the atmosphere, and the consequent necessity for an instrument of extreme delicacy, the change of contact resistance between two metals was used as a test. But no positive results were obtained.

Bollettino della Società Sismologica Italiana, vol. ii., 1896, N. 4.—Recent observations and results on the form and mode of propagation of seismic waves, by Dr. A. Cancani.—The seismic data of Liguria, with reference to their frequency and periodicity, by Dr. E. Oddone.—On the after-shocks of the great Japanese earthquake of 1854, by Prof. F. Omori.—Notices of earthquakes occurring in Italy during the year 1896, by Prof. L. Palazzo. This catalogue, a continuation of that formerly compiled by Dr. M. Baratta for the Central Meteorological and Geodynamic Office at Rome, contains accounts of all the shocks recorded from January 1 to June 14 The more important are those of Polesina on March 8, near Florence on April 15, in Asia Minor on April 16, and several earthquakes of unknown and distant origin on March 4, April 10, and May 2, 3, and 5.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, December 10.—"On Prof. Hermann's Theory of the Capillary Electrometer." By George J. Burch, M.A.

In reply to the claim of Hermann (*Archiv für die Ges. Physiologie*, vol. lxiii. p. 440), that his theory of the capillary electrometer received confirmation from the author's experimental results, the author stated that his own theory was completed before he saw Hermann's paper, that it was based upon a totally different hypothesis, and that the identity of Hermann's equation with his own is due simply to the fact that both are the mathematical expression of a movement which is dead beat. Hermann, adopting Lippmann's polarisation theory, had assumed the simplest conceivable relation between the rate of polarisation and the acting P.D., namely, that they are proportional to one another. The author's starting point was the fundamental fact that in the capillary electrometer a mechanical effect is produced by an electrical cause. Writing Q for the quantity of electricity, C for the constant of capillarity, P for polarisation, and W for the work done, the symbolical expression of the problem is—

$$f(Q_t, C_t, P_t) = \phi(W_t).$$

Hermann has passed over C and omitted to take W into account, confining himself to the theoretical relation between Q_t and P_t. But the term polarisation includes two phenomena, viz.:—

(*a*) That condition of the interface between two conductors, of which one at least is an electrolyte, in which the molecules are under a stress not greater than they are capable of supporting without chemical change.

(*b*) A deposit upon the surface of a solid, or in the contiguous liquid, of the products of actual electrolysis.

If one of the conductors is a solid, the inevitable local differences of condition or of composition enable actual electrolysis to take place even with a P.D. smaller than that proper to the chemical change implied. But if both conductors are liquid and perfectly pure, the stress is so far equalised that no electrolysis is possible until the E.M.F. reaches a certain value, more sharply defined in proportion as the materials are pure. The author holds that with differences of potential which do not reach this limit, the electromotive force is transmuted, without electrolysis, into mechanical force, ~~and~~ manifests itself as kinetic energy, until by the motion of the meniscus it becomes transformed into potential energy. The locus of transformation from electrical to mechanical force must clearly be the two interfaces mercury-acid and acid-mercury, and it is upon these that the stress acts. The resistance is distributed along the tube, and is partly electrical, but to a far larger extent mechanical. It does not seem reasonable, therefore, to assume that the sole cause of delay is the "polarisationsgeschwindigkeit" of the meniscus.

The author believes that in the case of an interface between two liquids, the rate of polarisation is to be measured in terms of the vibration period of a molecule, rather than in decimals of a second.

Actual electrolysis does not take place in a properly working electrometer, except with electromotive forces greater than ought to be employed.

According to the author, the capillary electrometer acts by transforming electrical into mechanical energy without any chemical interchange, this being possible because at the interface between two liquids which do not diffuse into each other the stress is so evenly distributed that no one molecule can be strained to a degree sufficient to detach any part of it until the stress is intense enough to break down all similar molecules simultaneously.

In order to investigate the motion of the meniscus under the action of a varying electromotive force, such as a pulsating or alternating current, Hermann puts his equation into the form

$$\frac{dp}{dt} + rp - r\epsilon f(t) = 0,$$

which is identical with the author's formula for the estimation of the E.M.F., viz.—

$$\mathrm{N} + k\Delta r = \frac{1}{0{\cdot}0133} \times f(t) \text{ volt,}$$

i.e.—

$$\left\{\begin{array}{c}\text{The sub-}\\ \text{normal}\\ \text{to the curve}\end{array}\right\} + \left\{\begin{array}{c}\text{A constant}\\ \text{multiple of the}\\ \text{distance from}\\ \text{the zero line}\end{array}\right\} = \left\{\begin{array}{c}\text{A constant}\\ \text{multiple of}\end{array}\right\} \left\{\begin{array}{c}\text{The}\\ \text{E.M.F.}\\ \text{at time } t\\ \text{in volts.}\end{array}\right\}$$

From this formula it is evident at once that the E.M.F. is zero whenever $\mathrm{N} = -k\Delta r$, and that the crossing of the zero line by the mensicus must always lag behind the change of sign of the E.M.F. Hence the curve can never come back to the zero line under the action of a current which pulsates but does not alternate. When N, *i.e.* $\frac{dp}{dt}$ vanishes, as it does at the apex of a spike or the bottom of a notch, the instantaneous value of the impressed E.M.F. is directly proportional to the distance of the meniscus from zero. The author has proposed that this method should be used to determine the characteristic current curves of dynamos.[1]

Royal Meteorological Society, December 16.—Mr. E. Mawley, President, in the chair.—An interesting paper, by Dr. Leigh Canney, on the winter climate of Egypt, was read by the Secretary. The climate of Egypt during the winter is influenced by the Libyan desert, by the Mediterranean Sea, and by the extent of cultivated land. The author gave the results of a series of observations which he had carried on during the past three winters. The observations were started with the object of arriving at a comparative knowledge respecting the climates of the various stations now considered as health resorts in Egypt, and by a strictly comparable method to arrive at the precise differences between the climates of Upper and Lower Egypt, all previous observations having failed in this respect. The stations at which observations were made were Cairo, Helouan, Mena House Hotel, Luxor, Assouan, Valley of the Tombs of the Kings, and the crest of the Libyan Hills. As self-recording thermometers and hair hygrometers were used at each station, valuable data have been obtained on the diurnal variation of temperature and humidity.—Mr. R. H. Curtis also read a paper on an attempt to determine the velocity equivalents of wind forces estimated by Beaufort's scale. The author has compared the anemometric records at Scilly, Fleetwood, Yarmouth, and Holyhead, with the wind forces as estimated by the observers at the same or adjoining stations, and has by this method obtained a satisfactory table of velocity equivalents in miles per hour for the estimated forces by Beaufort's scale.

Geological Society, December 16.—Dr. Henry Hicks, F.R.S., President, in the chair.—On the subdivisions of the carboniferous series in Great Britain, and the true position of the beds mapped as the Yoredale series, by Dr. Wheelton Hind. In this paper the author gave a summary of the knowledge of the local division of the Carboniferous system, and criticised the present classifications in vogue, laying special stress upon the local variations in the lithological characters of the rocks, and summing up to a large extent the fossil evidence which is available. He maintained that the Yoredale beds were largely the equivalents of the beds which had elsewhere been referred to the Mountain Limestone series, though some local beds which had been included in the Yoredale series might rather be the equivalents of the millstone grit. He would divide the rocks of the Carboniferous system into an Upper Carboniferous or Anthraciferous series, and a Lower Carboniferous or Calcareous series; and indicated the occurrence of three very different faunas in the Carboniferous rocks, viz.: (1) a Coal-Measure fauna rich in fish remains; (2) the Lower Coal-Measure and Grit fauna, largely marine but littoral; and (3) a Limestone fauna, essentially marine, very rich in brachiopods.—Note on volcanic bombs in the Schalsteins of Nassau, by Prof. E. Kayser. The bombs forming the subject of this communication occurred in two localities in the neighbourhood of Oberscheld near Dillenburg. They were generally rounded, though sometimes angular, and varied in size from that of a nut to that of a man's head. Each consisted of a kernel of coarse-grained rock representing a fragment of limestone altered by metamorphism, surrounded by a rind of amygdaloidal rock due to the inclusion of the fragment in molten lava. They demonstrated the pyroclastic origin of the Schalsteins, and also proved the similarity between the old Devonian volcanoes and those which were now active.

MANCHESTER.

Literary and Philosophical Society, December 15.—Prof. H. B. Dixon, F.R.S., in the chair.—Mr. J. C. Melvill read a paper on a collection of marine mollusca, mostly dredged by Mr. F. W. Townsend, who is officially connected with the Indian Oceanic Telegraph Company, whose cable extends from Kurachi to Bushire in the Persian Gulf. Mr. Townsend has made good use of the exceptional facilities he possesses for thus dredging the marine fauna, some forms being obtained attached to the cable itself, and some dredged in shallow, others in deep, water. The collections are of first-rate importance to the malacologist, the more so as this part of the North Indian Ocean has been curiously neglected in the past; the results have not yet been fully examined, but no less than thirty-two forms were described and differentiated as new to science. Of these the principal belonged to the genera *Nassa*, *Sistrum*, *Terebra* (one extraordinary form), *Mitra* (also very unusual in appearance), *Turritella*, *Coralliophila*, many *Trochi*, *Dentalium*, and, amongst Pelecypoda, *Yoldia* (a particularly interesting tropical form of an Arctic genus), *Pectunculus*, *Tellina*, *Donax*, *Chione*, and others.—On the ampullæ on specimens of *Millepora* in the Manchester Museum, by Prof. S. J. Hickson, F.R.S. The author stated that he had discovered ampullæ on several specimens in the museum. At least one of these belongs to the West Indian species *M. alcicornis*, and the observation suggests that all species of *Millepora* at some time produce medusæ similar to those of the Pacific Ocean species *M. murrayi*.

PARIS.

Academy of Sciences, December 21.—Annual Meeting.—M. A. Cornu in the chair.—The President's address was chiefly occupied with an historical retrospect of the X-rays. The losses by death during the year include the names of Fizeau, Tisserand, Reiset, Sappey, Daubrée, Resal, and Trécul.—The Arago medal has been awarded twice during the year, to M. A. Abbadie and to Lord Kelvin. The prizes offered for the present year have been awarded as follows:—In the section of Mathematics, the grand prize to M. E. Maillet for his work on the theory of substitutions, the Bordin prize to M. Jacques Hadamard for his memoir on the theory of geodesic lines, the Francœur prize to M. A. Valson, and the Poncelet prize to M. Painlevé for general contributions to mathematics. In the section of Mechanics, the extraordinary prize of 6000 fr. is divided between MM. Darrieus (for a work on the improvement of the naval forces),

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[1] "The Capillary Electrometer in Theory and Practice." (Reprinted from the *Electrician* of July 17 *et seq.*, 1896.)

Baule (for the application of the gyroscope to the determination of the altitudes of stars at sea), Schwerer, Blot, Monaque, Morache, Paqué, Terrier, and de Vanssay (for their magnetic observations). M. Henry Parenty receives a Montyon prize for his experimental researches on the theory of fluids, and M. Marbec the Plumey prize for his memoir on some applications of graphical mechanics. In Astronomy, the Lalande prize is given to M. P. Puiseux (for his selenographical work), the Valz prize to M. Bossert (for his reduction of older observations previously inaccessible), and the Janssen prize to M. Deslandres (for his studies in spectroscopy). No memoirs were received for the Damoiseau prize. In Statistics, a Montyon prize is taken by M. Huguet (for his study of the statistics of voluntary mutilation and assumed diseases in the army), and another by the *Comité des Compagnies d'Assurances a prime fixes sur la vie* (for a report on the tables of mortality used by them). In Chemistry, the Jecker prize is divided between MM. Matignon (for his thermochemical studies), V. Auger (for his researches on the chlorides of dibasic acids), M. Bouveault (for researches on the nitriles), and M. Genvresse (for work in organic chemistry). In the section of Mineralogy and Geology a Vaillant prize, which was offered for an experimental study of the physical and chemical causes which determine the existence of rotatory power in transparent substances, is awarded to M. Ph. A. Guye, and another, for which the subject of the theoretical and practical improvement in the methods of geodesy or topography was suggested, to M. C. Lallemand, for his contributions to the methods of levelling; whilst the Fontannes prize is given to M. Douvillé for his stratigraphical and palæontological researches. In the Botanical section M. E. Bescherelle receives the Desmazières prize, and M. Flagey a Montagne prize. In the section of Anatomy and Zoology, the Thore prize is taken by M. C. Janet, the Savigny prize not being awarded. In Medicine and Surgery, Montyon prizes are taken by M. Laskowski, for an anatomical atlas, by M. Legrain, for his studies on alcoholism, by MM. Imbert and Bertin-Sans, and MM. Oudin and Barthélemy, for their applications of the Röntgen rays in surgery and medicine. Honourable mentions are accorded to MM. Comby, Brocq and Jacquet, Broca and Maubrac. The Barbier prize is divided between MM. Bertrand and Fontan, and M. Raynaud; the Breant prize between M. Rénon and MM. Netter and Thoinot. The Godard prize is awarded to M. Max Melchior for his contribution on urinary infection, M. P. Delbet receiving an honourable mention. The Serres prize is divided equally between MM. Mathias Duval and Alfred Giard for their embryological studies, whilst M. Brun receives the Bellion prize, an honourable mention being accorded to M. Bodin. The Mège prize is awarded to M. Mauclaire, the Lallemand prize to M. R. Dubois, and the Baron Larrey prize to M. Edm. Delorme. In Physiology, M. Contejean receives a Montyon prize for his work on gastric digestion, Dr. Joachimsthal the Pourat prize for his experimental work on the locomotive apparatus, and M. Tissot, the Philipeaux prize for his study of the gaseous exchanges in isolated muscle. In the section of Geographical Physics, M. André Delebecque receives the Gay prize for his study of the French lakes. Of the general prizes, a Montyon prize is awarded to M. E. Cacheux for his construction of healthy workmen's dwellings, and other labours in connection with the improvements in the health and conditions of life of the working classes; the Trémont prize to M. Charles Frémont for his experiments on the effects of punching on metals; the Gegner prize to M. Paul Serret; the Delalande-Guérineau prize to M. Toutée for the scientific results of his expedition on the Niger; the Jean Reynaud prize to M. Henri Poincaré; the Jérome Ponti prize to MM. Benoit, Chapuis, and Guillaume, for the metrological work done in the International Metric Bureau at Breteuil; the Leconte prize (arrears) to M. Roussel, for his geological work in the Pyrenees, and to M. Henneguy for his researches on the development of the bony fishes; the Tchihatchef prize to Prince Henri d'Orleans, for his geographical work in Central Asia; the Houllevigue prize to M. Joannis, for his chemical researches; the Cahours prize to MM. Freundler, Lebeau, Hébert, and Varet; the Saintour prize to M. Renault, for his memoirs on vegetable palæontology and fossil bacteria, and to M. Guntz for his researches on fluorides, the alkali metals, and absorption of hydrogen and nitrogen by lithium; the prize founded by Mme. la Marquise de Laplace, to M. de Nanteuil de la Morville; and the prize founded by M. Félix Rivot, to MM. de Nanteuil de la Morville, Dutilleul, Balling, and Leroux.

DIARY OF SOCIETIES.

THURSDAY, DECEMBER 31.

ROYAL INSTITUTION, at 3.—Visible and Invisible Light: Prof. S. P. Thompson, F.R.S.

FRIDAY, JANUARY 1.

GEOLOGISTS' ASSOCIATION, at 8.—An Outline of the Petrology and Physical History of the Alps: Prof. T. G. Bonney, F.R.S.

SATURDAY, JANUARY 2.

ROYAL INSTITUTION, at 3.—Visible and Invisible Light: Prof. S. P. Thompson, F.R.S.

SUNDAY, JANUARY 3.

SUNDAY LECTURE SOCIETY, at 4.—Röntgen or X-Rays: Richard Kerr.

MONDAY, JANUARY 4.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—An Expedition to the Barotse Country: Captain A. S. Gibbons, Percy C. Reid, and Captain Alfred Bertrand.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—The Smelting and Refining of Cyanide Bullion: Arthur Caldecott.—The Industrial Use of a Recording Pyrometer: Prof. Roberts-Austen, C.B., F.R.S.

VICTORIA INSTITUTE, at 4.30.—Paper by Dr. F. A. Walker.

TUESDAY, JANUARY 5.

ROYAL INSTITUTION, at 3.—Visible and Invisible Light: Prof. S. P. Thompson, F.R.S.

WEDNESDAY, JANUARY 6.

GEOLOGICAL SOCIETY, at 8.—On the Structure of the Skull in a Pliosaur: C. W. Andrews.—On the Pembroke Earthquakes of August 1892 and November 1893: Dr. C. Davison.—Changes of Level in the Bermuda Islands: Prof. R. S. Tarr.

THURSDAY, JANUARY 7.

ROYAL INSTITUTION, at 3.—Visible and Invisible Light: Prof. S. P. Thompson, F.R.S.

FRIDAY, JANUARY 8.

ROYAL ASTRONOMICAL SOCIETY, at 8.

SATURDAY, JANUARY 9.

ROYAL INSTITUTION, at 3.—Visible and Invisible Light: Prof. S. P. Thompson, F.R.S.

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